

**METHOD AND EQUIPMENT FOR TAIL THREADING IN THE DRYER SECTION OF  
A PAPER MACHINE OR A SIMILAR MACHINE**

The present invention relates to a method and equipment for tail  
5 threading in the paper machine, in which tail threading is  
carried out in two stages as follows:

- the web is guided to broke treatment at a selected dryer,
- a cut is formed in the web to separate a narrow tail from the  
rest of the web, i.e. the broke web, prior to the said dryer,
- 10 - the tail is guided from the selected dryer to the following  
section while the broke web is transferred further to the broke  
treatment, and
- while travelling in a controlled manner, the tail is widened  
to the full width and the broke web is simultaneously reduced  
15 away.

In a modern paper or board machine the web transfer from the  
press section to the dryer section is typically carried out in  
a closed way without an open transfer by guiding the web at the  
20 full width until to the first dryer in the dryer section.  
Typically the first dryer of the dryer section is adapted to a  
so-called single fabric run.

The web can also be taken to the first dryer in a form of a  
25 narrow tail, which is then allowed to widen to the full width at  
the dryer. This is the method normally used for example in the  
paper machines, which have a traditional press type and an open  
web transfer from the press section to the dryer section. Other  
equipment, such as a threading blow unit or other drying unit,  
30 may be located between the press section and the first dryer.  
From the dryer, the web is typically allowed to travel through  
a doctor into a pulper located beneath the machine or to a broke  
conveyor or similar equipment situated below the machine.

35 Once the full-width web has reached the first dryer, only a  
narrow band of the web, a so-called tail, is first guided  
further to the end of the dryer section. In this system the tail

is arranged to follow the fabric at least partially when traveling further in the dryer section. Once the web end has been successfully transferred to the end of the dryer section or to the end of the desired part of the dryer section, the tail is  
5 widened to the full web width so as to permit taking the full-width web through the dryer section or a desired part of it.

Unless otherwise indicated, the term 'tail threading' is used below to refer to both the initial stage of tail threading,  
10 during which only a narrow tail is taken through the dryer section or similar, and the tail widening stage, during which the narrow tail is widened to a full-width web.

The web is typically transferred further in the dryer section by  
15 means of a separate narrow initial band, i.e. the tail, which has been cut from the web edge and which is first guided further in the dryer section. The rest of the web forms another, an almost full-width band, which is to be "run down", and which is not guided to the dryer section at the initial stage, but is  
20 taken at the first dryer doctor down to a pulper located under the machine or to a broke conveyor or similar equipment located under the machine.

The appropriate detachment of the various parts of the web from  
25 the dryer both during tail threading and normal operation is slightly problematic. During the normal operation the web should detach from the dryer at its full width immediately in the gap formed after the dryer and the fabric. In the tail threading situation, on the contrary, only a narrow tail or a widening  
30 tail threading band should detach from the dryer and the rest of the web, first the main part of the web, should remain attached to the dryer surface for a determined distance even after the opening gap.

35 Tail threading from the first dryer onwards may therefore be particularly problematic when running at high speeds, such as

speeds exceeding 1300 m/min. In such conditions, the edge nearest to the tail of the band to be taken down easily tends to follow the fabric further in the dryer section, since the action directed to the tail also affects this edge and vice versa. For example, it has been noticed that in certain cases the edges tend to drift on top of each other after the cutting point, which then tears the tail edge at the final stage of the widening operation.

10 To be able to carry out tail threading from the first dryer onwards using the tail, it must be prevented that the aforementioned second band, i.e. the main part of the web, starts to follow the web too early causing thus problems in the dryer section, such as excessive broke accumulation in the dryer  
15 section basement. Therefore, the main part of the web must be kept attached to the first dryer surface in a controlled way during tail threading even in the gap formed by the dryer and the fabric.

20 The web travelling from the press section easily detaches from the first dryer surface, because the web cannot have been attached to it properly, utilizing e.g. a nip, such as takes place in the press section, where the web is attached to the surface of a smooth roll by means of a nip. If the web were too  
25 strongly attached to the dryer surface, it would result in web detachment problems at the stage when it is finally desired to detach the web from the dryer.

Efficient high-vacuum blow/suction boxes have been developed for  
30 dryer sections. These boxes can be used to make the web controllably follow the dryer fabric during normal operation after the opening gap of the dryer and fabric, even when running at high speeds. By using these boxes it can be ensured that the actual narrow tail and the web part widening at the widening stage  
35 reliably follow the dryer fabric. Breaks must not be produced in either the tail or the widening web and therefore the web

transfer must take place in a controlled way. Because a very high vacuum is applied in these vacuum boxes, the web part to be run down may tend to follow the fabric in the tail threading stage instead of controllably following the first dryer and dropping down to the pulper or similar under the machine only at the dryer doctor.

International patent applications WO 98/3397 and WO 02/35001 propose some solutions for the aforementioned problems. The former publication makes known equipment, which uses two water cutters to cut a tail at the center of the web. At least one of the cutters is moved to the web from outside to ensure that the band remaining at the edge is sharp-edged and the tail is produced without an excess tail end. This, however, does not resolve the problems at the widening stage.

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The latter publication is even more closely related to the present invention. It discusses the aforementioned problem of arranging an appropriate detachment of the various web parts at each stage. It is attempted to prevent the edge nearest to the tail from following along by providing adjustable suction in the cross-machine direction on the outlet side of the dryer. The transfer zone of the vacuum box suction is synchronized with the spreader slide movement. In addition, a narrow intermediate band is formed between the actual tail and the web part running to the pulper. The intermediate band may be simply a wider cut produced with high pressure and a large amount of water. These solutions have disadvantages. A third band, leaving in an unspecific way, can after all cause problems later in the machine. A cut made applying a higher pressure wets and soils the fabric more than usually.

The objective of the present invention is to provide an improved method and equipment for tail threading in a paper machine or a similar machine.

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The objective of the invention is to provide a method and equipment in which the aforementioned problems have been minimized.

5 More particularly, the objective is to provide a method and equipment, which can be used to ensure a controlled tail travel through the dryer section.

A further objective is to provide a method and equipment, which  
10 can be used to prevent the web part to be taken down from travelling uncontrollably further in the dryer section.

Still another objective is to provide a method and equipment which can be used to controllably separate the tail and the band  
15 to be taken down and make them travel in a controlled way at and also after the gap opening at the first dryer. In addition, it is attempted to reduce the water pressure applied in the cutting operation to decrease the fabric load.

20 To achieve the aforementioned intentions, the method and equipment according to the invention are characterized in what is specified in the independent claims presented later herein.

The invention can be very favorably applied in a cylinder dryer  
25 section, in which at least the first cylinder dryer group is a so-called single fabric run adapted group, in which there is, in addition to a water cutting nozzle, tail squirt blow equipment prior to the first dryer, in the straight section of the dryer fabric for turning the web directed to broke and for forming an  
30 open draw. The web turning also means that the edge of the part directed to broke may become folded. The invention can be applied in other parts of the paper machine, too, especially after the dryer section, particularly at its end in tail threading to a finishing machine. The invention can also be used when  
35 the web is taken from the press to the dryer section with a so-called open transfer. The aim is to stop a break occurring in

the dryer section at the 1st dryer and to start tail threading.

The invention is described below in detail by making reference  
5 to enclosed drawings, which illustrate some of the embodiments  
of the invention.

Figure 1 is a schematic side view of the first dryer group of  
a paper machine

10 Figure 2 shows the cutting operation in tail threading seen  
from the fabric direction

Figure 3 is a lateral view of the cutting operation of Figure  
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Figure 4 illustrates the tail widening stage seen from above.

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Figure 1 shows the initial part of the first dryer group in a  
dryer section equipped with a single fabric run. The invention  
can be applied in other parts of the dryer group as well, in  
fact also in other parts of the paper machine (forming section,  
20 press section, dryer section, afterdryer section or coating  
section).

In the case of Figure 1 the web to be dried  $w$  is transferred by  
means of a transfer suction roll 10 to the dryer fabric  $F$  of the  
25 dryer group 12. The dryer fabric  $F$  guides the web over the first  
dryer  $C1$  and further through the first suction roll  $Vac1$  to the  
following dryer  $C2$  and so forth alternately over a dryer and a  
suction roll to the end of the dryer group. Instead of suction  
rolls, other components, known as such, can be used in the dryer  
30 group to guide the web travelling with the fabric support at the  
intervals between the dryers and the suction rolls.

A vacuum box 18 is adapted in the pocket formed by the dryers  $C1$   
and  $C2$  and the suction roll 16 to guide the web to be dried to  
35 the suction roll 16 during the operation in a manner known as

such in the gap 20 opening between the first dryer C1 and the dryer fabric F so that it controllably follows the dryer fabric.

After a machine shutdown or a web break the new web is brought to the dryer F at its full width by means of the transfer suction roll 10. The dryer F guides the full-width web over the first dryer C1 to the doctor 32, which drops it down to the pulper. The suction box 18 is not in operation at that time or its suction pressure is small.

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The cutting device 22, installed in a cross-directional slide, cuts a narrow tail from the web. The dryer fabric F is allowed to first take this narrow tail from the opening gap 20 forward in the dryer section. To detach the tail from the dryer C1, in a deeply opening gap (opening less than 40 mm) there is provided a blow device 16, consisting of a pipe whose width equals to that of the tail and which is provided with 1 mm bores with 20 mm's distribution.

20 Should another part of the web, i.e. the broke web, however, start to follow the tail, it is peeled off on the other side of the suction roll Vac1 with the blow equipment 19 and appropriate guides 21.

25 The cutting device 22 forming the tail can be any device suitable for cutting. In this example it is a water cutter. In the case of Figure 1 cutting takes place after the transfer suction roll in the straight section of the dryer fabric F. Cutting can also be arranged to take place earlier, i.e. prior to the transfer suction roll. However, it is essential that after the cutting, most preferably in the straight section of the dryer fabric, there is the first blow equipment 23, 24, whose operation and design will be discussed in greater detail hereinafter. Most advantageously these are mounted in the same slide 14 as the cutting device, because their cross-directional movement must synchronize with it.

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In Figure 2 the water jet 22' produced by the cutting device 22 cuts a narrow tail A from the web w which is travelling against the dryer fabric F while the rest of the web forms the broke web B. The blow nozzle 23, shown in the figure, provides a blow 5 23', which turns the edge B' of the broke web B away from the cutting point. The edge may also become folded, but the most important is that an open draw C is created at the cutting point.

10 According to Figure 3 the first blow equipment comprises of compressed air nozzles 23 and 24. The first of these is placed in a more vertical position than the second. The first one is usually at an angle of 30E to 70E (55E in the drawing) and the second 55E to 85E with respect to the perpendicular of the web 15 (w). Thanks to the edge-turning blow the water pressure of the cutting device can be decreased, which gives evident advantages. In addition to more successful tail threading compared to earlier, moistening and soiling of the dryer fabric also reduce.

20 Figure 4 illustrates the tail widening stage, during which the narrow tail A is widened to a full-width web, and the broke web is simultaneously reduced away. In the figure the widening operation is in the mid-way with the slide 14 travelling across the web. The original cut 11, shown in the drawing, divides the 25 full-width web w into a tail A and a broke web B. Before the widening operation the first blow equipment has been switched on thus creating an open draw C. As the widening proceeds, this follows the widening. The edge B' of the broke web can no more disturb the widening operation by tearing a break in the outsp- 30 read tail.

In principle, the invention can be applied with the initially mentioned zone-controlled suction box, although its need is not likely. A second and third set of blow equipment 16 and 19 also 35 improve the reliability of tail threading.